

The Age Computer

A simple device for improving age determination in censuses and surveys

PATRICK SCANLAND

AGE IS ONE OF THE MOST IMPORTANT demographic correlates. Almost all aspects of a person's life are related to it. Birth, of course, is perfectly age-specific, but so also—only less perfectly—are marriage, child-bearing, productive employment, formal education, military service, many diseases, death, and the dependence on others in childhood and in old age. Therefore it is absolutely essential that social and economic scientists and planners have access to information about the age distribution of the population in the communities they attempt to study or serve.

In many countries, however, large segments of the population have no certain knowledge of, or even interest in, their own ages. It is also generally in these same countries that vital registration systems are the least effectively developed. The dearth of data on age is most pronounced in countries in which no effective social security is in operation, formal education is not mandatory, and life is primarily focused on day-to-day subsistence. In such countries, people do not know their own ages, at least in part because there is little benefit in knowing them. In these circumstances, adequate age determination, either by means of a census or a sample survey, can be extremely difficult.

Methods of Improving Age Determination

In the usual census or survey, the information collected on age is based either on a statement by the person whose age is being recorded, on an estimate by another respondent (who may or may not be a relative), or on an estimate by the interviewer. It is generally recognized that the last two of these methods may not be satisfactory. A final solution of the age determination problem in such communities, of course, would be to instill into the community's consciousness the same level of age awareness that exists in the western countries,

while concurrently activating an effective vital events registration system. But since the social and economic problems of a community can rarely tolerate the amount of delay that the institution of such measures requires, other methods of dealing with the age determination problem have been tried, with more or less success. The most notable of these methods are:

1. Age smoothing techniques and other manipulations of the data after they have been collected and tabulated, such as by the Brass technique or fitting the data to standard life table curves. Unfortunately, this approach can remove from the expected normal statistical curves important real variations that may have been caused by wars, droughts, natural catastrophes, or economic upheavals; the investigator may be unaware of such events. In addition, some sophistication is re-

□ *At the time Mr. Scanland wrote this paper he was assistant survey advisor with the Afghan Demographic Studies, a project sponsored by the U.S. Agency for International Development and carried out jointly by the Research Foundation of the State University of New York and the Government of Afghanistan. He invented the age computer described in this paper. Currently, he is engaged in independent research in Indonesia, aimed at the preparation of a Balinese version of the age computer; compiling information for a simple dictionary of the Balinese language; and designing a training course in cohort analysis for demographers and decision makers, which is to be built around a three-dimensional system for depicting and analyzing historical demographic data, a system he developed with Dr. Otto Ravenholt, chief health officer of the Clark County Health District, Las Vegas, Nev.*

Tearsheet requests to Patrick Scanland, PO Box 271, Denpasar, Bali, Indonesia.

quired in fitting the data to life table curves that have been more or less subjectively chosen for their apparent relevance to the experience of the community being studied. Attempts are occasionally made to fit the raw age data to age distribution patterns in neighboring areas, although these data from neighboring areas have almost always been smoothed before being made available. The possibilities for going astray are numerous.

2. Cohort analysis of the data may be undertaken. This is a technique in which age data are collected at two or more points in time: the number of persons within an age cohort is compared with earlier or later measurements of the same group as its members age with the passage of time. Thus, an appropriate cohort analysis would be one in which the 10–14-year age group in 1955 is compared with the 15–19-year age group in 1960, since the two groups are comprised of the same people. Changes in the size of such a cohort or in its size relative to neighboring cohorts indicate possible areas of inaccuracy in the data. One difficulty with this approach is that misstatements about age in one enumeration may be repeated in subsequent ones. When this happens, cohort analysis will not show

any discrepancies. And, more basically, if cohort analysis is to be conducted, a prior enumeration must have taken place. When there has been none, such analysis is not possible.

3. Lists of historical events (national or local) may be used. This technique relies on the ability of the interviewing agency to prepare a list of historical events covering a relatively long period that will be truly memorable to the persons to be interviewed. The technique also requires interviewers to have the capacity to keep their list of events in chronological order and to perform addition and subtraction accurately. Since local historical events are often more memorable to provincial peoples than are national events, considerable time may be required to prepare the kind of detailed lists of local historical events that are needed.

Age Determination in Afghanistan

In 1971 the Research Foundation of the State University of New York contracted to provide the technical expertise for a national demographic and family guidance survey of Afghanistan, sponsored jointly by the U.S. Agency for International Development and the

Nomads in winter camping area in Nangrahar Province, southeastern Afghanistan. Survey team leader (center) wears karakul cap



Government of Afghanistan. My Afghan counterpart, Abdul Aziz Elyassi, and I shared responsibility with other members of the team for collecting the basic background information needed (a) for the preparation of the sample design, and (b) for the development and pretesting of interview schedules and of other materials (recordkeeping forms, for example) and of survey techniques (for example, techniques designed to obtain the cooperation of villagers and nomadic tribes or that would enable us to carry out the planned mapping and prelisting of communities). During the actual survey, we had primary responsibility for the scheduling and control of all work of the field teams—mapping, interviewing, quality control, and field logistics—and for the training and selection of fieldworkers.

A total of 33,000 interviews were completed: 30,000 from the settled population in 1972 and 1973 and 3,300 from the nomadic population in the summer of 1974. The interviews were conducted in selected sample areas in all parts of Afghanistan. In advance of the actual survey, teams of fieldworkers visited each sample site to list households and to either mark aerial photos or draw sketch maps. These materials were returned to the central office in Kabul, the capital city, and interview assignments were made on the basis of this information. Then a team of interviewers went to each sample site and interviewed members of the selected households. A total population estimate was prepared, as were estimates of vital rates and other demographic and social variables. One of the demographic measures most sought was, of course, the age distribution of the population.

Afghanistan is a country roughly the size of Texas. Its terrain ranges from barren desert to barren mountain peaks with modest amounts of cultivatable land lying between. Its population is made up of several distinct ethnic groups with distinct languages, groups that allegedly range from descendants of the hordes of Alexander the Great and of Genghis Khan to the Turkoman and Uzbek refugees from the Bolshevik Revolution in this century. The size of the population has been variously estimated at from 6 to 18 million. Roughly 90 percent of the people can neither read nor write. Life is harsh and dependent on the weather; the average annual rainfall for the country has been estimated at 12 inches. Some parts of the country are scarcely accessible, and in some areas, occurrences in other parts of the country are of little importance. For most of the population, life is a year-to-year, if not day-to-day matter. There is no effective national social security system. There has never been a national census. There is no effective vital registration system. A person has little reason to know or care about his age.

Afghanistan does have an identity card system in which all males with certain exceptions are required to participate. One of the main purposes of this system is to identify males for military service. Since the age stated at the time of application for the identity card

determines when the bearer will be required to go into military service, ages are often grossly misstated. Moreover, the cards often are not applied for until the person is several years old, and by that time no one may really know how old he is. Nevertheless, on those rare occasions when an Afghan male who has such a card is asked his age, he will generally give whatever age this card indicates. Few Afghan females hold such cards.

Old men are highly respected in this society of the extended family. They are known as "white beards"; white hair is enough to qualify a man as old. Old men, when asked their actual age, are almost as likely to say 80 as 65 because the higher the age the greater their status, and their actual ages do not really matter anyway. Among older men, then, age may be considerably exaggerated, and for this part of the population at least, misstatements about age may not be random. In such a setting, reasonably accurate age determination is unquestionably very difficult.

Ways to Improve Age Determination

In view of the difficulties in determining people's ages in Afghanistan, ways were sought to improve the process. We decided to use three kinds of information to try to overcome the difficulties—a list of national historical events, the Chinese animal years calendar, and lists of local historical events.

National historical events. A list of national historical events of Afghanistan was compiled by my counterpart and me in the expectation that it would reduce the amount of age smoothing that would be subsequently needed in the analysis stage.

Animal years calendar. On a preparatory field trip, we discovered that certain ethnic groups of Afghanistan, primarily the Turkoman, Hazara, and Uzbek groups, had knowledge of, and used, the animal years calendar commonly associated with Chinese peoples. In this calendar, there is a repeating cycle of 12 years and each cycle is named for a specific animal. Further probing revealed that although the people who use this calendar are not generally aware of their own ages, they often know in which animal year they were born. I therefore decided to use the animal years calendar as a second aid to age determination.

Local historical events. Having decided that a third type of information, lists of local as well as of national historical events, would be a valuable aid in age determination, we established a procedure for collecting and listing such events and prepared a form on which to record them (page 366). Since Afghanistan is primarily agrarian, events such as droughts, floods, and unusual rainfalls and snowfalls are often highly memorable to Afghan villagers. Destructive earthquakes are also remembered, as is the building of such structures as

village mosques, schools, or bridges. The dates of some of these events are verifiable, and others are not. The appointment of a malik (a village leader who is given some official responsibilities and sanction by the central government) is a memorable event, since maliks play an important part in village life. Moreover, the dates of their appointments can be verified, since each malik is given an official seal marked with the date. In many villages, the births of a few members of leading families will have been recorded in family Korans. Since these persons are generally well known locally and are of verifiable age, their births can be treated as local historical events. Special celebrations and battles with other villages are also memorable local historical events.

Development of Age Computer

Age and chronological time measured in years bear a direct one-to-one relationship to each other. Therefore I began to design some sort of device that would take advantage of that relationship and help the interviewer determine the age of respondents systematically. The first attempt resulted in a device that resembled a long slide rule, in which a list of historical events and animal years cycles could be slid past a list of possible ages. Although the device was simple to construct and did the job for which it was intended, it was bulky and seemed too unwieldy for convenient use in the field.

To correct these defects, I changed the design from a linear to a circular one, with an upper plate over a slightly larger lower plate. A center pin served to hold the two plates together and permitted them to rotate freely in relation to one another. A small age readout window was cut into the top plate. A decision to divide the circles into 96 parts was primarily a result of the discovery that although calibration of the device in its circular format was an exacting and delicate job, accurate division of a circle into 96 parts was relatively easy. (See age computer, page 364.)

The top plate of the age computer used in Afghanistan is printed with four concentric rings of information. These rings, from inside to outside, carry the following information:

1. Heads of State of Afghanistan. The listing about the reign of the last King of Afghanistan is further subdivided to permit the listing of Prime Ministers in addition to the head of State.
2. The Muslim calendar years from 1259 through 1353. The Muslim year 1353 is roughly comparable to 1974 on the Christian calendar.
3. Historical events. National historical events are preprinted in this ring. Space is left for writing in local events.
4. The names of the years of the 12-year cycles of the animal calendar.

On the historical events rings, a small window has been cut in the middle of the space for the current

year. This is the readout window for age. It reveals one of the numbers on an otherwise hidden ring of numbers printed on the plate below.

The bottom plate is printed with two identical rings of numbers ranging from 0 to 95 or more. As already mentioned, one of these rings is hidden beneath the upper plate. Only one number of this ring is visible through the age readout window at any one time. The number revealed through this window at the completion of questioning is the age of the respondent during the year of the interview. The second, or outer, ring on the bottom plate lists all possible ages from 0 through 95 or more. This ring of possible ages is used to align the age that the respondent recalls he was at the time of a certain historical event with the listing of that event.

In the circular format, the device was compact and easily transportable in the field. The interviewer no longer had to carry lists of events that could become disarranged. The device freed the interviewer from any necessity of adding or subtracting. It was an excellent attention-getting device. Furthermore, once a historical event was aligned with the reported age of the respondent at the time of a certain event in his life, all the other listed events that had occurred during the respondent's lifetime were then automatically aligned with what should have been the age of the respondent at the time each of those events occurred, provided the initial reported age was accurate. For example, if the device indicated that the respondent was 5 years old at the time of the initial event that aligned with his reported age, not only would he be 38 years old at the time of the interview, but he must have been 12 at the time of another event, 23 at the time of yet another event, and so on. It then was possible to quickly check the accuracy of the respondent's initial recollection of his age at the time of a certain event against his recollection of his age at the time of other events that occurred during his lifetime.

Fieldwork Procedures

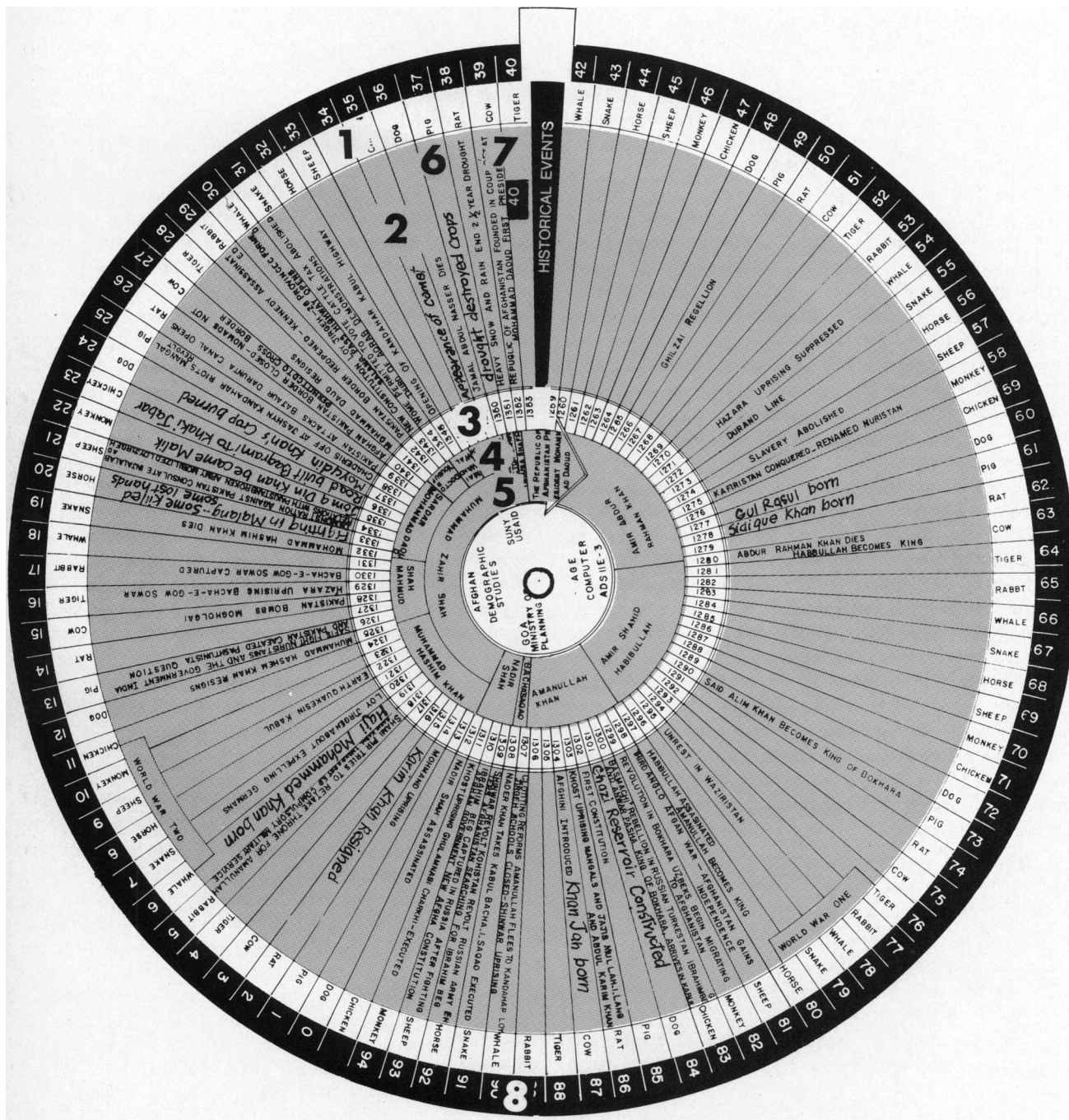
In Afghanistan, to carry out a project such as a national survey, it is absolutely essential that the fieldworker observe a series of formalities if he is to gain the cooperation of the persons he plans to interview. Therefore the teams that were to do the village mapping and prelisting (and later, the interviewing teams) had to carry letters of introduction from the ministry in which they worked to the provincial governor, who in turn provided introductions to the woluws (roughly the equivalent of county governors), who in turn called the maliks (or village leaders) to their offices and instructed them to cooperate with the field teams. The maliks then assured their village populaces that it was all right to cooperate with the prelisting and mapping field teams. The purpose of the project and the methods by which it was to be carried out were explained to the officials at each of these levels.

TOP PLATE

1. Animal calendar years
2. National historical events
3. Muslim calendar years
4. Prime ministers
5. Heads of state
6. Local historical events
7. Age read-out window

BOTTOM PLATE

8. Possible years of age



Age computer with information on it translated into English. Since this computer was used in Malang Village, Khaki Jabar Woluswali, Kabul Province, Afghanistan, the local historical events for that village have been handwritten onto it.

During the period when members of the prelisting and mapping teams were introducing themselves and the project to the malik of a village, the team also questioned the malik and village elders in considerable detail about memorable events that had occurred in the village and filled out a local historical events form for that village. When the prelisting and photo marking or sketch mapping were completed, the prelists, photos or maps, and local historical events forms were sent to the central office in Kabul. From these documents the interviewing assignments were made. At the same time, the local historical events were transcribed onto a set of age computers prepared specifically for each village. The interview assignments, interview schedules, and age computers (already marked with the local historical events) were dispatched to the regional offices as a package. The interviewers then went to each sample village, repeated the introductory formalities, and carried out the interviews. No additional time was required to obtain the information about local historical events. Moreover, the interviewers did not have to concern themselves with the matter. They received premarked age computers and put them to work immediately.

Age Determination With Age Computer

The steps that are normally taken in determining a person's age with the age computer are as follows:

1. The interviewer first obtains a rough estimate of the respondent's age. He may do this either by simply looking at the respondent and guessing his age or by asking approximately how old the person thinks he is. In some cases, the interviewer will learn at this stage that the respondent knows exactly how old he is, usually because his parents have recorded his birth in a family Koran. When that occurs, the age of that particular respondent has been determined. However, in the national survey of Afghanistan, respondents only rarely had such information. When they do not, the interviewer should so align the plates of the age computer that the initial rough estimate of the respondent's age appears in the window of the upper ring.

2. At this point the interviewer will note that he has aligned a whole series of historical events that should have occurred within the respondent's lifetime with the age that the respondent must have been at the time of occurrence of each of those events, provided that the initial estimate of his age was correct.

3. If the respondent is a member of one of those ethnic groups that have knowledge of the 12-year cycle of animal years (in Afghanistan, primarily the Turkomans, Uzbeks, and some Hazaras), the interviewer should ask if the respondent knows in which animal calendar year he was born. If he does, the rings of the age computer should be adjusted either forward or backward so that the age 0 coincides with one of the listings for an animal year of that name. If the initial estimate has indicated that age 0 was very

close to an animal calendar year of that name, then probably the interviewer has already determined the respondent's correct age. If, however, the interviewer finds that age 0 is approximately midway between two listings of animal calendar years of that name, he will have to do more probing to determine which of the nearby animal calendar years of that name was the one in which the respondent was born.

4. The next step is to begin probing for recollection of the various events that the age computer indicates ought to have occurred in the respondent's lifetime. Recollections of age at the time of events early in a person's life are more likely to be accurate than recollections of age at the time of events later in life. Therefore, the probing for recollections of events that should have occurred relatively early in the respondent's life is encouraged. If the respondent's recollection of his age when listed historical events occurred indicates that the top plate of the age computer should be adjusted a few years one way or another, then this adjustment is made. However, the adjustment is not made when a conflict would be caused with an age that has been determined by knowledge of the animal calendar year of the respondent's birth. At this point the interviewer should have a pretty good fix on the age of the respondent. The age seen in the age readout window is recorded in the interview schedule.

In some cases it is necessary to use other aids to determine age. In Afghanistan it is commonly accepted that a person loses his baby teeth at age 7. This assumption may in fact be correct in view of Afghan nutritional standards (although this loss is commonly believed to occur at age 6 in America). A respondent can be asked if an event occurred before or after he lost his baby teeth. The average age at puberty can also be used in the same way if the average can be adequately pinned down. When all else fails, a male respondent can be asked if an event occurred before or after he entered military service, since military service in Afghanistan is supposed to begin at age 22. However, by the time a man has entered military service, the possibilities for error in age estimation have become sizable. As another last resort, a man can be asked how old his identity card indicates he is. Since, however, many men do not obtain identity cards until it is nearly time for them to enter either the job market or military service, this approach is to be avoided whenever possible. As mentioned, almost no females have identity cards, and few females enter military service. Therefore neither of these approaches is useful in determining the ages of female respondents.

Effectiveness of Age Computer

Initial evaluation of the age computer's effectiveness has shown that it is helpful in overcoming some of the difficulties encountered in age determination in countries such as Afghanistan. Because it does not require the interviewer to add or subtract, it totally elim-

LOCAL HISTORICAL EVENTS FORM

Date _____

Province

Woluswali

City/village

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Urban-1 1-Center
Rural-2 2/6-Village

1. Record of maliks, etc. (most recent first):

Name	When became malik	When stopped being malik
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2. Persons of known age:

Name	Title	Birth date	Source of verification
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3. Well-known constructions:

Name or description	When work began	When opened for use
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- a. Roads
- b. Mosques
- c. Other buildings (including bridges)
- d. Canals

4. Notable natural disasters:

Description	When occurred
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- a. Earthquakes
- b. Floods
- c. Fires
- d. Rain and snows

5. Epidemics and famines:

Description	When occurred
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6. Battles:

Description	When occurred
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7. Other unusual or notable events:

Description	When occurred
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NOTE: Blanks were left in the original form for answers to be entered, but have been omitted here to conserve space.
Ed.

inates the kind of mathematical errors that can plague surveys in which inexperienced and often only moderately educated interviewers use lists of historical events as memory aids. Because the age computer keeps the lists of historical events always in order, it is convenient for the interviewer to use. Moreover, by creating an aura of advanced technology around the person controlling this seemingly mysterious age-telling device, it helps catch the attention of the respondent and win his cooperation. And because the device automatically indicates which events should have occurred at specified ages of the respondent's life, once an initial estimate of the respondent's age has been made, it provides simple checks on the respondent's recollections.

Although the age computer uses lists of historical events as memory ticklers and use of such events for age determination is not ideal, there are often no better alternatives. Reliance on the respondent's own idea as to his age and the ages of other members of his extended family can result in incredibly inaccurate data. For example, of 25,000 persons in one survey in Kabul, not one admitted to being 39 years old (39 being a dirty word in Afghanistan), and only two or three claimed to be 31 (I never found out what was wrong with 31). Use of the age computer in our survey enabled us to arrive at a much more normal number of persons aged 31 and 39, since the interviewer could work out the respondent's age with the aid of this device without the respondent's biases having a chance to affect results.

The age computer is not a final answer to the problem of age determination. A number of difficulties remain. At its best, the device only indicates the age that the respondent is, or will be, during the year of the interview. If the respondent's birthday actually falls after the date of the interview, the age computer will have overstated his age in terms of completed years of life by 1 year. For surveys and enumerations conducted late in a calendar year, this difficulty will be of less significance than when the interview takes place early in a calendar year.

In addition, the age computer is most accurate when the respondent is recalling his own age or the age of his children at the time of certain historical events. When a respondent answers for all members of an extended household, some of whom are not even his blood relatives, the ages stated are less likely to be accurate.

Nevertheless, a comparison of "age-heaping" (preference for numbers ending in zero or five) in the Afghan national survey with age heaping in other smaller Afghan surveys suggests that the age computer somewhat reduces that difficulty. A preliminary comparison, based on Whipple's index, of the age distributions in the Afghan national survey with those found in surveys of India, Iran, and Turkey (all countries with more extensive survey and census experience than Afghanistan) shows that digital preference in Afghanistan's first national survey was less marked than that occurring in India, Iran, or Turkey. Similar preliminary comparisons based on Myers index tend to confirm these results.

More sophisticated evaluation of the effectiveness of the age computer must await further stringent statistical analysis of the data generated in this first national survey in Afghanistan. At this point it appears that the age computer did not introduce errors as marked as those it minimized or eliminated.

In Afghanistan, we used the age computer in a surprising range of conditions and for a variety of people, from Hazara urbanites in Kabul to Pashtun nomads in the Hindu Kush. In some situations it was more useful than in others, but it never damaged our effort. Currently, Afghanistan family planning clinics and a hospital in Kabul are using it to determine the ages of patients.

In Bali, where I am now living, I am trying to prepare a Balinese version of the age computer that will incorporate the different calendars of varying numbers of days that are in use here. I hope that readers of this article will adapt the age computer to conditions in other settings and will find it effective.

SYNOPSIS

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Age determination in a community in which the residents neither know, nor are interested in, their own ages can be very difficult. Techniques exist for manipulating age data once they are collected, but these very techniques can cause error as well

as minimize it. Also, some of them cannot be used in all circumstances.

An age computer, a simple semi-automatic device that determines age by use of lists of historical events, has apparently alleviated some of the worst difficulties in age determination. It was used recently in a massive national demographic and family guidance survey conducted in Afghanistan. Although statistical measurement of the actual effectiveness of the device in re-

ducing age-determination problems has been only partially carried out, the results of such evaluation suggest that errors in age determination were reduced by means of the age computer.

Such a device would be useful in census and survey work carried out in populations in which determinations of age present difficulties similar to those found in Afghanistan, although it would have to be adapted to the community being studied.